

CIA/PB 131632-78

AUGUST 7 1959

Sanitized - Approved for Release - CIA-RDP81-00440R000200460006

**UNCLASSIFIED - INFORMATION ON SOVIET
BLOC INTERNATIONAL GEOPHYSICAL COOPERATION
- 1959**

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August 7, 1959

U. S. DEPARTMENT OF COMMERCE
Office of Technical Services
Washington 25, D. C.

Published Weekly
Subscription Price \$12.00 for the Series

INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM --
SOVIET-BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Soviets Report Launching of Second Geophysical Rocket on 10 July

The following TASS report on the 10 July launching of a second Soviet geophysical rocket was carried in Soviet newspapers dated 14 July.

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"In the course of fulfilling the plan of scientific work on the investigation of the upper layers of the atmosphere, the routine launching of a geophysical ballistic rocket, similar to the rocket launched on 2 July, was made on 10 July at 0414 Moscow time.

"In addition to the program of investigations published on 7 July of this year, measurements of the infrared radiation of the Earth and the Earth's atmosphere, photographing of the cloud masses over a large territory, the simultaneous analysis of the ion and neutral composition of the atmosphere, and the measurement of the electrostatic fields were made.

"Two experimental dogs were in the rocket. One of these, Otvazhnaya, was lofted for the fourth time.

"The animals and apparatus were recovered in good condition.

"Data on all points of the program were obtained.

CPYRGHT

"The payload amounted to 2,200 kilograms." (Routine Launching of Geophysical Ballistic Rocket," Moscow, Pravda, 14 Jul 59, p 1)

Dobronravov Discusses Recovery Vehicle

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"The creation of artificial earth satellites, recoverable within a determined period of time, is a necessary stage in the future study of cosmic space," writes Prof V. Dobronravov, Doctor of Physical-mathematical Sciences, in an article on the 2 and 10 July geophysical rocket launchings by the Soviets. "It can be assumed," he says, "that the use of parachute means alone for recovery, which were used in the launching of some Soviet geophysical rockets, will be inadequate for recovering a satellite, particularly a manned-satellite. For recovery, a satellite is needed which would be a unique form of glider, as well, and have devices preventing the rocket's rotation around its horizontal and vertical axes." ("Secrets of the Cosmos Are Revealed," by Prof V. Dobronravov; Moscow, Promyshlennno-Ekonomicheskaya Gazeta, 15 Jul 59, p 1)

Sputnik III Flies On

Sputnik III completed 6,000 revolutions of the Earth on 15 July 1959 at 1940 Moscow Time.

During the 426 days of its existence, it has travelled 272.8 million kilometers. In this same time, its orbital period has decreased from 105.95 minutes to 98.45 minutes, and its apogee has dropped from 1,880 kilometers to 1,175 kilometers.

Observations by both optical and radio methods are continuing. Up to now, the coordinating-calculating center has received and processed over 105,000 radio measurements and more than 35,000 optical observations. These data were sent by Soviet and foreign telemetry stations, astronomical observation points and observatories.

The radio signals from the "Mayak" transmitter, operating on a frequency of 20.005 megacycles, are still being received by radio stations and hams throughout the world. The main sources of power for the transmitter are the solar batteries. These batteries have operated more than 7,700 hours. Experimental data on the technical and operational qualities of the solar batteries obtained during this period are of great value for future designs of solar power sources.

The chemical power sources on Sputnik III also continue to function. This ensures power for the transmitter in those parts of the satellite's orbit lying in the Earth's shadow. The chemical batteries have operated about 2,500 hours up to now.

Observations on the propagation of radio signals from the "Mayak" transmitter, which are being conducted in the most varied points of the globe and at different times of the year and day, make it possible to obtain additional information concerning the ionosphere and the laws of radio wave propagation. ("Satellite Continues Flying Around the Earth," Moscow, Sovetskaya Aviatsiya, 15 Jul 59, p 4)

II. UPPER ATMOSPHERE

Study of Sq Variations of Magnetic Field

As a result of 11 years of observations (1933-1945), which were conducted in Tbilisi (Karsani and Dusheti), on quiet day (Sq) variations and other characteristic phenomena, it is known that Tbilisi lies in the transition zone. Outside of this zone, switching of the Sq type variations of the horizontal intensity H of the magnetic field into a diametrically opposite form is observed, that is, to the south, the equatorial (E) form is observed, to the north, the polar (P), and in the

designated transition zone, very frequently, the transitional form (E,F). Such days comprise 48, 42, and 10 percent, respectively, of all quiet days of the period studied. Frequently the polar (P) is observed, while the equatorial (E) is rarely observed.

The present work strives to do the following: (1) an explanation of the problem whether the variation of types of Sq variations of H, which are observed in Tbilisi, are planetary or merely local in character; and (2) the determination, if only approximately, of the width of the zone in which identical and simultaneous changes of Sq variations of H occur.

The data of some magnetic observatories in the middle and lower latitudes, not for quiet days alone, but for a period of not less than one year, were considered for this purpose.

Using the data from other stations in the world, the radius of the zone within the limits of which changes in the types occur simultaneously with Tbilisi were roughly established. These limits are approximately twice the following: The change of types of Sq variations in Tbilisi are dispersed within the limits of 30 to 100 E and of 30 to 46 N.

A quantitative comparison of changes in types of Sq variations of H with other cosmic phenomena, particularly with the state of the visible surface of the Sun and with the state of the ionosphere and Earth currents, gave no positive results. It was, however, noted that the phenomenon of changes in the types of Sq variations is planetary in character and appears in different form, depending on local conditions.

Current research has proven the existence of strong winds in the upper atmosphere. These result because, during the appearance of active areas on the Sun, the emission of highly active ultraviolet radiation (flares) occurs. In these conditions, the temperature changes sharply, whereby, in addition to the vertical gradient, there is a high horizontal gradient causing strong winds.

The phenomena of winds in the upper atmosphere are used as the basis to assume that the changes in Sq variations from day to day can be explained by oscillations in the system of electrical currents connected with the variable direction of winds in the E-layer of the ionosphere.

The movement of the conducting layers of the atmosphere caused by such winds can definitely, of itself, be the occasion of the instability of the diurnal variation of magnetic elements and even of changes in the form of Sq variations of H.

As a result of solar flares, the temperature of the high layers of the atmosphere must increase sharply. As a result of this, the pressure of the air will decrease in spots. This can create strong winds of a local nature. The latter, on their part, can cause shifting of the centers of electric current systems from the equator to the poles or, conversely, also in the same way, changes in the types of Sq-variations in the transition zone. The stronger and more lasting the winds, the larger will be their radius of action, and the larger will be the area enveloped by changes in the types of Sq variations of H. ("Problem on Determining the Width of the Zone for Identical Changes in Types of Sq Variations of H," by N. A. Katsioshvili, Institute of Geophysics, Academy of Sciences Georgian SSR, Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol 21, No 5, Nov 58, pp 523-529)

Solar Flares Disrupt Radio Communication

A very large group of sun spots appeared from beyond the limb of the Sun's disk on 8 July. These spots are usually accompanied by flares. A bright flare was actually registered at 0516 hours Moscow time on 10 July, and on 11 July a magnetic storm began.

The strongest chromospheric flare recently was noted on 14 July at 0642 hours. It lasted about 3 hours and 20 minutes. This flare caused an unusually strong magnetic storm which began about 1100 hours on 15 July and caused an ionospheric disturbance, i.e., a sharp increase of ionization in the electrical conducting layer of the atmosphere from which radio waves are reflected. As a result of these effects, prolonged disruptions of radio communication in the short waves over the entire world were noticed. Radio communication between Europe and America was even cut off for a short time.

According to the observations of a number of Soviet Sun Service stations and ionospheric stations near Moscow and in Murmansk, Leningrad, Alma-Ata, Tomsk, and Ashkhabad and other stations, the magnetic storms and disturbances of the ionosphere continued all day on 16 and 17 July, sometimes increasing, at other times, decreasing. On the 17th, toward evening, these phenomena gradually abated. However, momentary interruptions in radio communication could still be observed in certain places the next day. ("Strong Explosions on the Sun," by V. Lutskiy; Moscow, Izvestiya, 18 Jul 59, p 3)

Direct Proof of Ducts in Atmosphere

The refraction of solar radiation in the vicinity of the horizon was measured with a 20-centimeter radioastronomical receiver. The time at which the center of the sun passes the horizon was derived from the eclipse curve of the solar disk, and the zenith distance was computed from the known position of the sun; the obtained refraction values were 40 percent greater than the optical values, and the scattering range was also considerably greater. As proof, the refraction was computed from the geometric configuration of radiation derived from the characteristic values of the troposphere, taken from synoptical reports. The method of calculation can be applied to a spherical, arbitrarily stratified troposphere. The measured and computed refraction angles for sunrises and sunsets were tabulated side by side for the purpose of comparison.

Since the refraction angle fluctuates from day to day as a result of the constantly changing total composition of the troposphere, it is considered inconceivable that improvements of the average refraction values for individual position measurements could be made solely from measurements of the air pressure, temperature, and humidity at the ground during position measurements.

The refraction angles obtained for 20 centimeters are about 10 percent below those obtained for the metric wave range by McCready, Pawsey and Payne-Scott (Proc. Royal Soc., 190, 1947, p 357). It is considered possible that the higher values could be interpreted as indications of the participation of the ionosphere in refraction.

On a certain few days, the measurements produced direct proof of the presence of ducts in the atmosphere, which heretofore had to be deduced indirectly from vhf-propagation studies.

When there are abrupt changes of the refraction index in the troposphere, a reflection takes place, if the incidence of the waves is oblique. The reflected portion can, at times, be so strong that the radiation of a distance transmitter can, as it were, be "directed" between this layer and the surface of the earth. On 2 out of 59 days of sunset observations, the sun, after actually setting, still radiated a considerable portion of its energy to the receiving antenna via such a reflecting layer. In one instance, 40 percent of the total radiation was still recorded by the receiver 5 minutes after radioastronomical sunset. Such a recording is considered direct proof of the presence of "ducts" in the troposphere. ("The Refraction of Decimeter Waves in the Troposphere," by O. Hachenberg and R. Schachenmeier, Heinrich Hertz Institute, Berlin-Adlershof; Leipzig, Hochfrequenztechnik und Elektroakustik, Vol 68, No 1, May 59, pp 1-7)

III. METEOROLOGY

New Soviet Airborne Meteorograph Described

A new airplane meteorograph (index A-10) of improved design was developed in the Scientific Research Institute of Hydrometeorological Instrument Building (NIIGMP), under the supervision of S. I. Nepomnyashchiy.

The working principle of the instrument is based on the transformation of elastic deformations of the sensor elements, during changes in the values being measured, into mechanical movements to an indicating band and then recorded on tape.

The meteorograph consists of the following measuring units: pressure, temperature, humidity, and velocity of air flow in a shaft. The pressure, or barograph element, is an aneroid cell with a temperature compensator; the temperature element is a thermostatic element consisting of low magnetic steel and invar steel; the sensing element for measuring the relative humidity of the air makes use of seven strands of human hair (five hair per strand) held in position by brackets and clamps; the velocity element has an additional function. Registering the velocity of the air flow in the shaft, it permits corrections for speed to be introduced into the readings of the temperature and humidity indicators more rapidly and accurately than through the use of the usual air speed indicators. The sensing element for registering the velocity of the air flow in the shaft is a manometric, thin-walled, membranous box whose inner chamber is connected to a thin L-shaped tube, the other end of which is directed into the flow of air in the shaft. In this way, measurement of velocity is made without hermetically sealing the instrument housing by calibrating the unit in a wind tunnel.

"Special phenomena," as the limits of cloudiness, the beginning or end of icing zones, bumpiness of the airplane, etc., are recorded on the drum by means of a pen controlled from inside the airplane cabin by the aerologist.

The registration of changes in the meteorological elements is made on a paper-covered drum, rotated by a clock mechanism.

The airplane meteorograph is a comparative instrument registering: (a) air pressure in a range of 110-250 millibars; (b) temperature in a range from ± 45 degrees to -60 degrees; (c) humidity from 20 to 100 percent, and (d) the velocity of air flow from 50-300 kilometers per hour.

The measurement accuracy of the meteorological elements under laboratory conditions, determined according to the maximum point spread for three calibrations, is: pressure, ± 3 millibars; temperature, ± 0.5 degrees; and humidity, ± 7 percent.

The new airplane meteorograph has a distinct advantage in comparison with the SM-43 meteorograph, namely, greater accuracy of measurement, less inertial lag (one half) in temperature and humidity reception, easier and quicker processing of pressure data owing to the presence of bimetallic compensation, a more reliable clock mechanism, and other features. ("New airplane Meteorograph for Vertical Sounding of the Atmosphere," by S. I. Nepomnyashchiy; Leningrad, Meteorologiya i Gidrologiya, No 1, Jan 59, pp 51-54)

Chinese Offer New Method of Computing Vertical Motion of Air

A new method of computing the vertical motion of air based on the assumption of the isallobaric wind is proposed by Wu You-shen, Nanking University. Some qualitative rules for estimating the distribution of vertical velocity are given. These rules may be employed in routine forecasting. ("A New Method of Computing Vertical Motion Under the Assumption of Isallobaric Wind," by Wu You-shen; Peiping, Acta Meteorologica Sinica, Vol 30, No 1, 1959, pp 72-84)

Chinese Scientists Suggest Method of Seasonal Forecasting

A method of seasonal long-range weather forecasting is suggested by Yang Chien-ch'u, Institute of Geophysics and Meteorology, Academia Sinica, and Shih Chiu-en and Ai Tzu-hsing, Central Institute of Meteorology Research, Central Weather Bureau. It is based on the classification of natural synoptic periods, the rhythm of different types of natural periods, and the correlations between periods. ("A Method of Seasonal Long-Range Weather Forecasting," by Yang Chien-ch'u, Shih Chiu-en, and Ai Tzu-hsing; Peiping, Acta Meteorologica Sinica, Vol 30, No 1, 1959, pp 53-63)

IV. OCEANOGRAPHY

Report on Physical Oceanography by Academia Sinica

The article "Some Characteristics of the Physical Oceanography of the Gulf of Chihli and the Western Part of the North Yellow Sea," by the Physical Oceanography Group of the Institute of Oceanography, Academia Sinica, appeared in a Chinese scientific periodical. It was received for publication 25 September 1958.

The article is designated as "Survey Report No 82 of the Institute of Oceanography, Academia Sinica."

Subheadings of article are as follows:

- (1) Distribution of hydrographical elements and variations
- (2) Distribution of ocean currents
- (3) Chemical composition (particularly soluble oxygen and phosphates) of the sea waters
- (4) Analysis of samples of sea bottom deposits with respect to physical properties
- (5) Characteristics of the coastal land forms -- smooth coast and indented coast. ("Some Characteristics of the Physical Oceanography of the Gulf of Chihli and the Western Part of the North Yellow Sea," by the Physical Oceanography Group of the Institute of Oceanography, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 11, 11 Jun 59, pp 363-364)

V. ARCTIC AND ANTARCTIC

Glaciological Observations in Antarctica

The coast of East Antarctica from the Rauer Island in the west to the Windmill Archipelago in the east, a distance of about 1,500 kilometers, was covered by aerial photography in 1956-1957, on a scale of 1:50,000. Individual sections were photographed on a larger scale. The aerial photography materials, together with visual observations from the air and on the ground, made it possible, for the first time, to compile reliable and sufficiently detailed maps of this part of the antarctic coast and to determine the basic features in the morphology and dynamics of glaciers in the littoral portion of the ice sheet.

Using aerial photography materials of the Complex Antarctic Expedition, the Division of Aerial Photography under Soyuzmorproyekt (State Institute for Planning Maritime Ports and Ship Repair Enterprises), Ministry of Maritime Fleet USSR, with the participation of the author of this article, compiled a map with a scale of 1:1,000,000 for the section of the antarctic coast between 72 and 114 degrees E and 64 and 72 degrees S. The material of this map served as the basis for the survey map published with this article, with a scale of 1:3,000,000. In 1958, Soyuzmorproyekt began the compilation of map sheets with a scale of 1:100,000.

In carrying out aerial photography, some portions of the glaciers with adjoining outcrops of basic rocks were photographed twice, with intervals of about one year. This laid the foundation for some interesting experiments to determine the direction and speed of movement of glaciers according to repeated aerial photographs. The results obtained illustrate the great advantages of such a method.

The results of these glaciological observations are briefly described in this article.

According to the type of relief and the special features of glacier morphology and dynamics, the explored sector of the antarctic coast is not homogeneous. The following basic types of glaciers are found in this area: continental glacier, ice caps, ice shelf, and drift glaciers.

1. The continental glacier forms the basis of glaciation in Antarctica. Its area and ice thickness is many times greater than that of all other types of glaciation, which are merely subsidiary forms of the continental glacier. The continental ice of East Antarctica represents a huge flat or convex sheet, reaching an altitude of 3,000-4,000 meters in its central parts. It may be divided into two regions:

a. The central region of the continental glacier is where the ice is extremely thick (1,000-3,000 meters or even more). Irregularities of the subglacial relief are hardly noticeable in the surface structure. Only the very largest subglacial mountain ranges and depressions slightly break the monotony of the ice desert. An anticyclonic weather regime with extremely low temperatures prevails in this region. Despite the small amount of precipitation, there is a steady accumulation of snow. The snow turns into ice very slowly, without the process of thawing (recrystallization type of ice formation); therefore, the snow cover is very thick (up to 100 meters and more). The ice is not visible anywhere on the surface. A flow of ice from the central regions to the periphery apparently takes place, which serves to maintain the accumulation and wastage balance of the ice sheet; however, no outward signs of ice movement can be observed on the surface. Crevasses are encountered very rarely. In moving from the center to the periphery, the surface of the ice sheet descends, at first, gradually and then more and more steeply, slowly changing over into the marginal region of ice mounds.

b. The marginal region of ice mounds surrounds the central region of the ice sheet with a belt measuring from 20-30 to 100 kilometers in width. In this region, the ice thickness is greatly reduced, and the subglacial relief is clearly revealed in the morphology of the ice surface. A characteristic feature of this zone is a marked increase in the speed of ice movement towards the periphery and the large number of pressure arches, dynamic crevasses, hillocks and ridges.

This zone, which is subject to strong cyclonic influences, has a much greater amount of precipitation than the central zone. The maximum precipitation (600-700 millimeters) falls in the area where the slope of the ice cap meets the level of moisture condensation in the prevailing air masses. Thus, the antarctic ice sheet is apparently fed mainly by its borders.

The metamorphosis of snow into ice in the border zone takes place much quicker than in the central zone because of the greater effect of thawing (recrystallization-infiltration type of ice formation). The stormy wind regime produces a very irregular distribution of the snow cover. On hillocks and protruding crests of slopes, where the snow is continuously blown off by the wind, ablation often exceeds accumulation (ablation occurring mainly through evaporation), despite the fact that these sectors are usually several hundred meters above the climatic snow line.

The analysis of materials of aerial photography and ground observations in the marginal zone of ice mounds has resulted in the distinction of two basic groups of glacier formations: outlet glaciers and ice slopes. These differ from one another in their morphological features and dynamic peculiarities, and a number of transitional forms exist in between.

The outlet glaciers represent the most mobile sections of the borders of the antarctic ice sheet and are, as a rule, drawn out lineally in the direction of the glacier movement. The most characteristic feature of outlet glaciers is the enormous quantity of dynamic crevasses, which cover the glacier surface in such a dense network that it becomes practically impassable for all types of mechanized transport.

Another characteristic feature of their surface are the longitudinal ice ridges with dividing troughs, which represent pressure folds formed by the lateral pressure from the ice slopes feeding the glacier. On large outlet glaciers, the systems of lengthwise ridges can be traced for many kilometers. As a rule, the ridges run parallel to each other in the channel of the flow, and after entering the zone of floating glacier deltas, they fan out in several directions. As the outlet glacier enters the zone of floating ice, large crevasses are formed in the glacier body, perpendicular to the movement of ice. These intersect the lengthwise pressure ridges and split the glacier into separate blocks, which represent the beginnings of future icebergs.

The icebergs originating from outlet glaciers have a peculiar morphology, i.e., their surface is not flat and even like that of tabular icebergs, but dome-shaped and crisscrossed by a multitude of cracks. They are usually higher than the tabular icebergs. For example, the icebergs produced by the Denman Glacier are about 50-70 meters above ocean level, while the icebergs calved from the adjoining parts of the Shackleton Ice Shelf are usually about 20-30 meters high.

The outlet glaciers have many varying forms, beginning with gigantic ice rivers between icy and rocky banks, which occupy deep subglacial fiords and tectonic depressions (for example, Denman Glacier, which is almost 200 kilometers long and 15-30 kilometers wide), and ending with flat, spread-out glaciers with undefined outlines (for example, Posadowsky Glacier or the unnamed glacier descending into McDonald Bay west of Mirnyy). Some outlet glaciers have well developed floating deltas, for example, Helen Glacier, which apparently exist in connection with the extension of the glacier bed along the sea bottom.

The Denman, Scott, Northcliffe, Obruchev, and Apfel-Edisto glaciers have a huge, common delta which cuts through the Shackleton Ice Shelf. The outlet glaciers press the body of the ice shelf in the direction of the open sea. Many outlet glaciers which reach the open sea do not form ice tongues; on the contrary, they frequently form bays at the terminals of the outlet glaciers. The edge of the continental ice in such places has the appearance of being chipped off (for example, McDonald Bay and the bays at the terminals of the Jones, Posadowsky, and several other glaciers). This is apparently caused by the presence of wide, deep bays near the edge of the glacier ice in these places, which cause immediate calving of icebergs as soon as the glacier reaches a floating position.

The speed of movement of outlet glaciers varies greatly, fluctuating between several hundred meters and 1,000-2,000 meters per year. The outlet glaciers occupy about 30 percent (500 kilometers in length) of the explored coastal area. [Continued in next week's report.] (Glaciological Observations in Antarctica, by L. D. Dolgushin; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geograficheskaya, No 6, Nov/Dec 58, pp 16-19)

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